Leading Indicators for Systems Engineering Effectiveness

Presentation for System and Software Technology Conference
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SYSTEMS ENGINEERING LEADING INDICATORS GUIDE

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Growing Interest in SE Effectiveness

- Questions about the effectiveness of the SE processes and activities are being asked
  - DoD
  - INCOSE
  - Others
- Key activities and events have stimulated interest
  - DoD SE Revitalization
  - AF Workshop on System Robustness
    - Questions raised included:
      - ***How do we show the value of Systems Engineering?***
      - ***How do you know if a program is doing good systems engineering?***
    - Sessions included SE Effectiveness measures and Criteria for Evaluating the Goodness of Systems Engineering on a Program

Background of the Systems Engineering Leading Indicators Project

"SE Leading Indicators Action Team" formed in late 2004 under Lean Aerospace Initiative (LAI) Consortium in support of Air Force SE Revitalization

The team is comprised of engineering measurement experts from industry, government and academia, involving a collaborative partnership with INCOSE, PSM, and several others

- Co-Leads: Garry Roedler, Lockheed Martin & Donna Rhodes, MIT ESD/LAI Research Group
- Leading SE and measurement experts from collaborative partners volunteered to serve on the team

The team held periodic meetings and used the ISO/IEC 15939 and PSM Information Model to define the indicators.

PSM (Practice Software and Systems Measurement) has developed foundational work on measurements under government funding; this effort uses the formats developed by PSM for documenting the leading indicators

A Collaborative Industry Effort

LAI MIT
LEAN ADVANCEMENT INITIATIVE ™

INCOSE
International Council on Systems Engineering

LOCKHEED MARTIN

NORTHROP GRUMMAN
DEFINING THE FUTURE

Raytheon

BOEING

SYSTEMS ENGINEERING
Research Center

BAE SYSTEMS

SEA RI
Systems Engineering Advancement Research Initiative

PSM

Software Engineering Institute | Carnegie Mellon

NDIA
National Defense Industrial Association

... and several others

Objectives of the project

1. Gain common understanding of the needs and drivers of this initiative
2. Identify information needs underlying the application of SE effectiveness
   - Address SE effectiveness and key systems attributes for systems, SoS, and complex enterprises, such as robustness, flexibility, and architectural integrity
3. Identify set of leading indicators for SE effectiveness
4. Define and document measurable constructs for highest priority indicators
   - Includes base and derived measures needed to support each indicator, attributes, and interpretation guidance
5. Identify challenges for implementation of each indicator and recommendations for managing implementation
6. Establish recommendations for piloting and validating the new indicators before broad use

SE Leading Indicator Definition

- A measure for evaluating the effectiveness of a how a specific SE activity is applied on a program in a manner that provides information about impacts that are likely to affect the system performance objectives
  - An individual measure or collection of measures that are *predictive of future system performance*
    - Predictive information (e.g., a trend) is provided before the performance is adversely impacted
  - Measures factors that *may impact the system engineering performance*, not just measure the system performance itself
  - Aids leadership by providing insight to take actions regarding:
    - Assessment of process effectiveness and impacts
    - Necessary interventions and actions to avoid rework and wasted effort
    - Delivering value to customers and end users

Leading Indicators

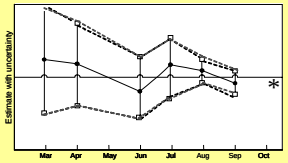
Sources of ignition

Smoke detectors

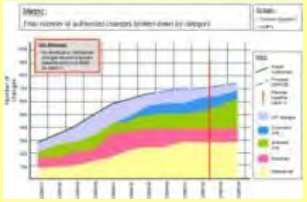
Fire alarms

Fires

Engineering Capability

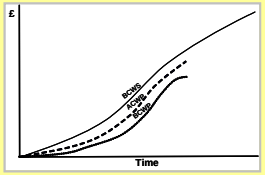


Engineering Performance



Engineering Status

Financial Indicators



Causes ← *Consequences*

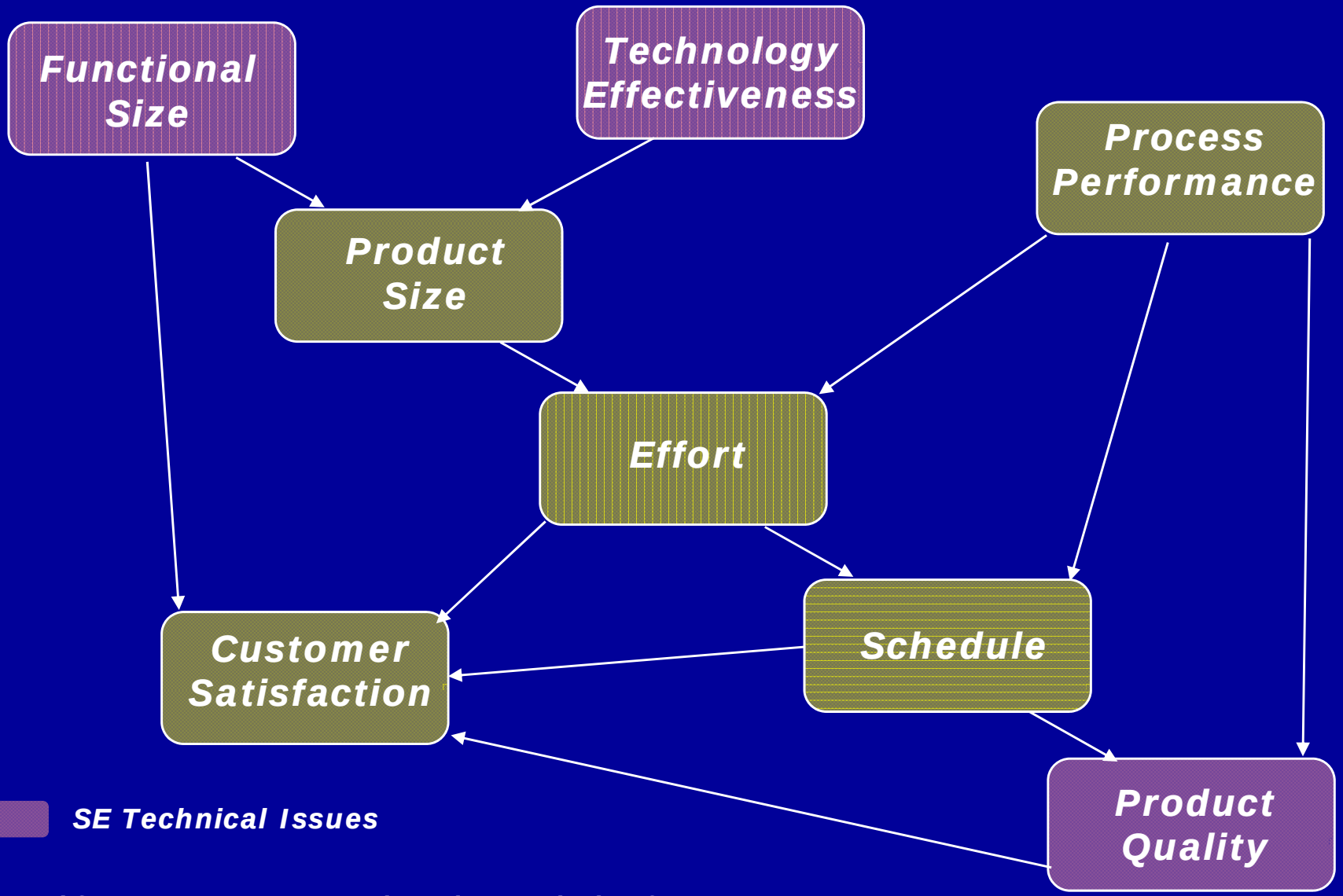
Need to monitor drivers and triggers

Performance not meeting plans

Product not maturing fast enough

Behind schedule, unpredictable

Interactions Among Factors



Adapted from J. McGarry, D.Card, et al., *Practical Software Measurement*, Addison Wesley, 2002

Criteria of Leading Indicators

- Early in activity flow
- In-process data collection
- In time to make decisions
  - Actionable
  - Key decisions
- Objective
- Insight into goals / obstacles
- Able to provide regular feedback
- Can support defined checkpoints
  - Technical reviews, etc.
- Confidence
  - Quantitative (Statistical)
  - Qualitative
- Can clearly/objectively define decision criteria for interpretation
  - Thresholds
- Tailorable or universal

Used criteria to prioritize candidates for inclusion in guide

Systems Engineering Leading Indicators

Objective: Develop a set of SE Leading Indicators to assess if program is performing SE effectively, and to enhance proactive decision making

- Thirteen leading indicators defined by SE measurement experts
- Beta guide released December 2005 for validation
  - Pilot programs conducted
  - Workshops conducted
  - Survey conducted
    - 106 responses
    - Query of utility of each indicator
    - No obvious candidates for deletion

- Version 1.0 released in June 2007
- Version 2.0 released in Feb 2010
  - Enhancements and lessons learned
  - 5 additional leading indicators

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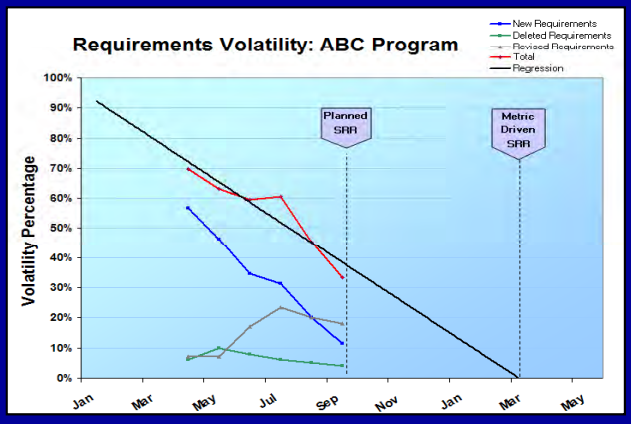


List of Indicators (Original Set)

- Requirements Trends (growth; correct and complete)
- System Definition Change Backlog Trends (cycle time, growth)
- Interface Trends (growth; correct and complete)
- Requirements Validation Rate Trends (at each level of development)
- Requirements Verification Trends (at each level of development)
- Work Product Approval Trends
  - Internal Approval (approval by program review authority)
  - External Approval (approval by the customer review authority)
- Review Action Closure Trends (plan vs actual for closure of actions over time)
- Technology Maturity Trends (planned vs actual over time)
  - New Technology (applicability to programs)
  - Older Technology (obsolesence)
- Risk Exposure Trends (planned vs, actual over time)
- Risk Handling Trends (plan vs, actual for closure of actions over time)
- SE Staffing and Skills Trends: # of SE staff per staffing plan (level or skill - planned vs. actual)
- Process Compliance Trends
- Technical Measurement Trends: MOEs (or KPPs), MOPs, TPMs, and margins

Original set had 13 Leading Indicators

List of Indicators (added in Version 2.0)

- Facility and Equipment Availability (availability of non-personnel resources needed throughout the project lifecycle)
- Defect and Error Trends (defect discovery profile over time)
- System Affordability Trends (cost/effort/schedule/performance distributions)
- Architecture Trends (architecture process maturity, system definition maturity, architecture skills)
- Schedule and Cost Pressure (impact of schedule and cost challenges)

Version 2 Added 5 Leading Indicators

Fields of Information Collected for Each Indicator

- Information Need/Category
- Measurable Concept
- Leading Information Description
- Base Measures Specification
  - Base Measures Description
  - Measurement Methods
  - Units of Measure
- Entities and Attributes
  - Relevant Entities (being measured)
  - Attributes (of the entities)
- Derived Measures Specification
  - Derived Measures Description
  - Measurement Function
- Indicator Specification
  - Indicator Description and Sample
  - Thresholds and Outliers
  - Decision Criteria
  - Indicator Interpretation
- Additional Information
  - Related SE Processes
  - Assumptions
  - Additional Analysis Guidance
  - Implementation Considerations
  - User of the Information
  - Data Collection Procedure
  - Data Analysis Procedure

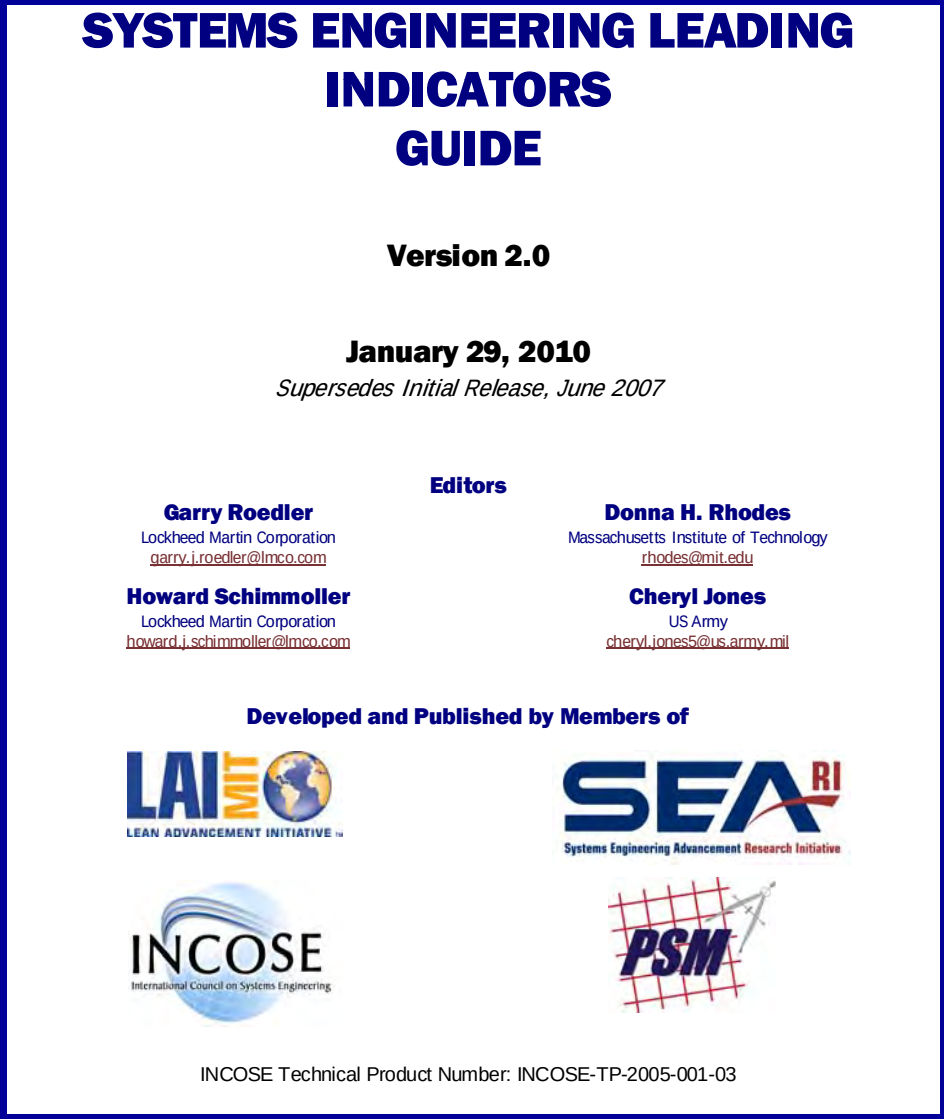
Derived from measurement guidance of PSM and ISO/IEC 15939, Measurement Process

Guide Contents

1. About This Document
2. Executive Summary
   - Includes mapping of indicators to life cycle phases/stages
3. Leading Indicators Descriptions
   - Description of each indicator, example graphics, and detailed definitions with all fields of information
4. Implementation Considerations
   - Includes Cost-Benefit, Leading Indicator Performance, Composite Indicators, Mapping to SE Activities
5. References

Appendices

- NAVAIR Applied Leading Indicator Implementation
- Human Systems Integration Considerations
- Early Identification of SE-Related Program Risks



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INCOSE Technical Product Number: INCOSE-TP-2005-001-03

- http://www.incose.org/ProductsPubs/products/seleadingIndicators.aspx
- http://www.psmsc.com

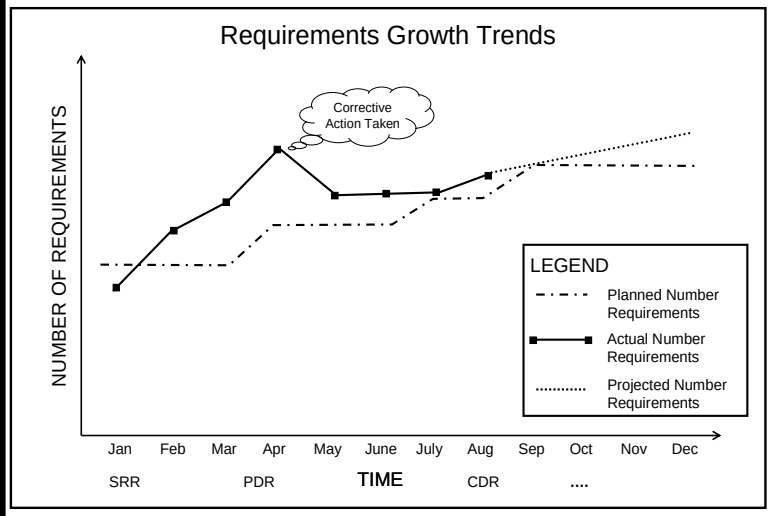
Example of Section 3 Contents

1.1 Requirements Trends

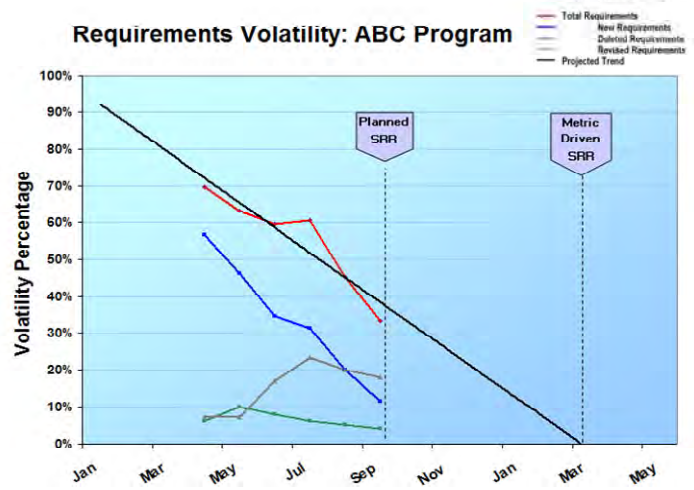
This indicator is used to evaluate the trends in the growth, change, completeness and correctness of the definition of the system requirements. This indicator provides insight into the rate of maturity of the system definition against the plan. Additionally, it characterizes the stability and completeness of the system requirements which could potentially impact design, production, operational utility, or support. The interface trends can also indicate risks of change to and quality of architecture, design, implementation, verification, and validation, as well as potential impact to cost and schedule.

An example of how such an indicator might be reported is show below. Refer to the measurement information specification below for the details regarding this indicator; the specification includes the general information which would be tailored by each organization to suit its needs and organizational practices.

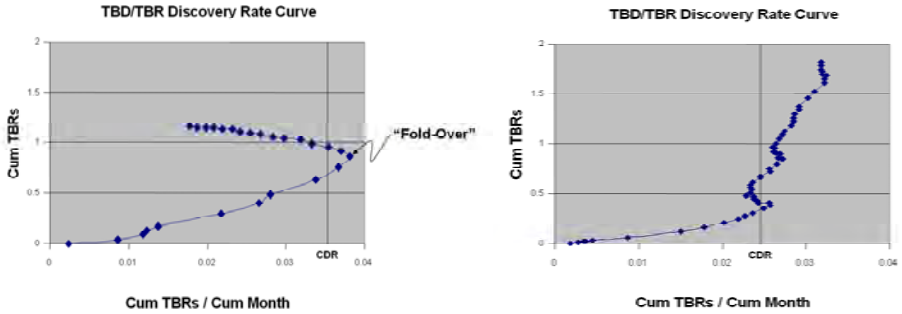
Requirements Trends



Requirements Trends. The graph illustrates growth trends in the total number of active requirements in respect to planned number of requirements (which is typically based on expected value based on historical information of similar projects as well as the nature of the project). The measures shown could apply to all levels of abstraction from high-level to detailed requirements. Based on actual data, a projected number of requirements will also be shown on a graph. In this case, we can see around PDR that there is a significant variance in actual versus planned requirements, indicating a growing problem. An organization would then take corrective action – where we would expect to see the actual growth move back toward the planned subsequent to this point. The requirements growth is an indicator of potential impacts to cost, schedule, and complexity of the technical solution. It also indicates risks of change to and quality of architecture, design, implementation, verification, and validation.



Requirements Volatility. The graph illustrates the rate of change of requirements over time. It also provides a profile of the types of change (new, deleted, or revised) which allows root-cause analysis of the change drivers. By monitoring the requirements volatility trend, the project team is able to predict the readiness for the System Requirements Review (SRR) milestone. In this example, the project team initially selected a calendar date to conduct the SRR, but in subsequent planning made the decision to have the SRR be event driven, resulting in a new date for the review wherein there could be a successful review outcome.



TBD/TBR Discovery Rate. The graphs show the cumulative requirement TBDs/TBRs vs. the ratio of cumulative TBDs/TBRs over cumulative time. Each point represents a successive instance in time as you move along the graph from bottom to top. The plot provides an indication of the convergence and stability of the TBDs/TBRs over the life cycle of the project. The graph on the left shows a desirable trend of requirement TBD/TBR stability; as the ratio of decreases and the cumulative number of TBDs/TBRs approaches a constant level. This "fold-over" pattern is the desirable trend to look for, especially in the later stages of project life cycle. In contrast, the graph on the right shows an increasing number of TBDs/TBRs even as the project approaches later stages of its life cycle; this is a worrisome trend in system design stability. An advantage of this plot is that, by shape of the graph (without having to read

Graphics are for illustrative purposes only – may reflect a single aspect of the indicator.

Example of Section 3 Contents (Cont'd)

1.1.1 Requirements Trend Specification

Requirements Trends	
Information Need Description	
Information Need	• Evaluate the stability and adequacy of the requirements to understand the risks to other activities towards providing required capability, on-time and within budget. • Understand the growth, change, completeness and correctness of the definition of the system requirements.
Information Category	1. Product size and stability – Functional Size and Stability 2. Also may relate to Product Quality and Process Performance (relative to effectiveness and efficiency of validation)
Measurable Concept and Leading Insight	
Measurable Concept	Is the SE effort driving towards stability in the System definition and size?
Leading Insight Provided	• Indicates whether the system definition is maturing as expected. • Indicates risks of change to and quality of architecture, design, implementation, verification, and validation. • Indicates schedule and cost risks. • Greater requirements growth, changes, or impacts than planned or lower closure rate of TBDs/TBRs than planned indicate these risks. • May indicate future need for different level or type of resources/skills. • Indicates potential lack of understanding of stakeholder requirements that may lead to operational or supportability deficiencies.
Base Measure Specification	
Base Measures	1. Requirements 2. Requirement TBD 3. Requirement Defe 4. Requirement Cha 5. Requirement Cha
Measurement Methods	1. Count the numbe interest; e.g., Pro Priority Levels, Ca Times) 2. Count the numbe attributes of inter States, Priority Le Dates & Times) 3. Count the numbe of interest; e.g., Priority Levels, Ca Times) 4. Count the numbe of interest; e.g., Priority Levels, Ca Times) 5. Estimate the impa

Requirements Trends	
Unit of Measurement	1. Requirements 2. Requirement TBDs/TBRs per associated 3. Requirement Defects per associated att 4. Requirement Changes per associated at 5. Effort Hours per Requirement Change (hours expected for each change)
Entities and Attributes	
Relevant Entities	• Requirements
Attributes	• Requirement TBDs/TBRs • Requirement Defects • Requirement Changes • Additional attributes including but not li Disposition Action, Maturity States, Prior Classification Type, and Dates & Times events
Derived Measure Specificat	
Derived Measure	1. % Requirements Approved 2. % Requirements Growth 3. % TBDs/TBRs Closure Variance per Plan 4. % Requirements Modified 5. Estimated Impact of Requirements Changes for a given time interval (in Effort Hours) 6. Requirement Defect Profile 7. Requirement Defect Density 8. Requirement Defect Leakage (or Escapes) 9. Cycle time for Requirement Changes (each and average)
Measurement Function *	1. (Requirements Approved / Requirements identified and defined)*100 for a given time interval 2. ((Requirements in current baseline - Requirements in previous baseline) / (Requirements in previous baseline) * 100 3. ((TBDs/TBRs planned for closure – TBDs/TBRs closed) / TBDs/TBRs planned for closure) * 100 4. (Requirements Modified / Total Requirements) * 100 for a given time interval 5. Sum of estimated impacts of Requirement Changes during a given time interval 6. Requirement Defects for each defect category 7. Requirement Defects / Requirements as a function of time 8. Subset of Requirement Defects found in a phase subsequent to its insertion 9. Elapsed time (difference between start and stop times) or total effort

Requirements Trends	
Indicator Specification	
Indicator Description and Sample	Line or bar graphs that show trends of requirements growth and TBD/TBR closure per plan. Stacked bar graph that shows types, causes, and impact/severity of changes. Show thresholds of expected values based on experiential data. Show key events along the time axis of the graphs. 1. Line or bar graphs that show growth of Requirements over time 2. Line or bar graphs that show % Requirements Approved over time 3. Line or bar graphs that show % TBDs/TBRs not closed per plan 4. Line or bar graphs that show % Requirements Change 5. Line or bar graphs that show Estimated Impact of Requirements Change for a given time interval (in effort hours) 6. Line or bar graphs that show Defect Profile (by types, causes, severity, etc.) 7. Line or bar graphs that show Defect Density 8. Stacked bar graph that shows types, causes, and impact/severity of Requirements Changes
Thresholds and Outliers	Organization dependent.
Decision Criteria	Investigate, and potentially, take corrective action when the requirements growth, requirements change impact, or defect density/distribution exceeds established thresholds <fill in organization specific threshold> or a trend is observed per established guidelines <fill in organizational specific>.
Indicator Interpretation	• Used to understand the maturity of the system definition • Used to understand impact on system definition and impact on production. • Analyze this indicator for process performance and other relationships that may provide more "leading perspective". • Ops Concept quality may be a significant leading indicator of the requ com • Care drivi Requ func • Revi o o o o o • Func

Requirements Trends	
Additional Information	
Related Processes	Stakeholder Requirements, Requirements Analysis, Architectural Design
Assumptions	• Requirements Database, Change Control records, defect records are maintained & current. • TBDs and TBRs are recorded and tracked.
Additional Analysis Guidance	• May also be helpful to track trends based on severity/priority of changes • Defect leakage - identify the phases in which defect was inserted and found for each defect recorded.
Implementation Considerations	• Requirements that are not at least at the point of a draft baseline should not be counted. • Usage is driven by the correctness and stability of requirements definition. o Lower stability means higher risk of impact to other activities and other phases, thus requiring more frequent review. o Applies throughout the life cycle, based on risk. o Track this information per baseline version to track the maturity of the baseline as the system definition evolves.
User of Information	• Program/Project Manager • Chief Systems Engineer • Product Managers • Designers
Data Collection Procedure	• See Appendix F
Data Analysis Procedure	• See Appendix F

Systems Engineering Leading Indicators Application to Life Cycle Phases/Stages

Table 1 - SYSTEMS ENGINEERING LEADING INDICATORS OVERVIEW

Leading Indicator	Insight Provided	Phases / Stages									
		P 1	P 2	P 3	P 4	P 5	S 1	S 2	S 3	S 4	S 5
Requirements Trends	Rate of maturity of the system definition against the plan. Additionally, characterizes the stability and completeness of the system requirements which could potentially impact design and production.	●	●	●	●	●	●	●	●	●	●
System Definition Change Backlog Trend	Change request backlog which, when excessive, could have adverse impact on the technical, cost and schedule baselines.			●	●	●		●	●	●	
Interface Trends	Interface specification closure against plan. Lack of timely closure could pose adverse impact to system architecture, design, implementation and/or V&V any of which could pose technical, cost and schedule impact.	●	●	●	●	●	●	●	●	●	
Requirements Validation Trends	Progress against plan in assuring that the customer requirements are valid and properly understood. Adverse trends would pose impacts to system design activity with corresponding impacts to technical, cost & schedule baselines and customer satisfaction.	●	●	●	●	●	●	●	●	●	
Requirements Verification Trends	Progress against plan in verifying that the design meets the specified requirements. Adverse trends would indicate inadequate design and rework that could impact technical, cost and schedule baselines. Also, potential adverse operational effectiveness of the system.	●	●	●	●	●	●	●	●	●	●
Work Product Approval Trends	Adequacy of internal processes for the work being performed and also the adequacy of the document review process, both internal and external to the organization. High reject count would suggest poor quality work or a poor document review process each of which could have adverse cost, schedule and customer satisfaction impact.	●	●	●	●	●	●	●	●	●	
Review Action Closure Trends	Responsiveness of the organization in closing post-review actions. Adverse trends could forecast potential technical, cost and schedule baseline issues.	●	●	●	●	●	●	●	●	●	●

Indicator's Usefulness for Gaining Insight to the Effectiveness of Systems Engineering (1 of 2)

Indicator	Critical	Very Useful	Somewhat Useful	Limited Usefulness	Not Useful	Usefulness Rating *
Requirements Trends	24%	35%	11%	3%	3%	4.1
System Definition Change Backlog Trend	7	11	7	3	1	3.9
Interface Trends	14	12	4	0	1	4.3
Requirements Validation Trends	22	16	4	0	1	4.4
Requirements Verification Trends	37	23	6	2	1	4.4
Work Product Approval Trends	7	19	21	2	0	3.9
Review Action Closure Trends	5	33	21	5	0	3.9
Risk Exposure Trends	14	37	6	1	0	4.3
Risk Handling Trends	6	25	11	1	0	4.1
Technology Maturity Trends	6	6	7	0	0	4.1
Technical Measurement Trends	21	27	6	0	0	4.4
Systems Engineering Staffing & Skills Trends	11	27	15	0	0	4.2
Process Compliance Trends	6	14	11	1	0	4.0

** Defined on the Slide .* *Somewhat Useful* *Very Useful*

Note: Reflects Version 1 indicators only

Percentages shown are based on total survey responses. Not all indicator responses total to 100% due to round-off error or the fact that individual surveys did not include responses for every question.

Indicator's Usefulness for Gaining Insight to the Effectiveness of Systems Engineering (2 of 2)

- Usefulness Ratings defined via the following guidelines:
  - 4.6-5.0 = Critical: Crucial in determining the effectiveness of Systems Engineering
  - 4.0-4.5 = Very Useful: Frequent insight and/or is very useful for determining the effectiveness of Systems Engineering
  - 3.0-3.9 = Somewhat Useful: Occasional insight into the effectiveness of Systems Engineering
  - 2.0-2.9 = Limited Usefulness: Limited insight into the effectiveness of Systems Engineering
  - Less than 2.0 = Not Useful: No insight into the effectiveness of Systems Engineering

Additional Information on Specific Application and Relationships

1. Cost-effective sets of Base Measures that support greatest number of indicators
2. Indicators vs. SE Activities of ISO/IEC 15288
3. Application of the SE Leading Indicators for Human System Integration (HSI)
4. Application of the SE Leading Indicators for Understanding Complexity

SELI versus SE Activities of ISO/IEC 15288

	Requirements Trends	System Definition Change Backlog Trend	Interface Trends	Requirements Validation Trends	Requirements Verification Trends	Work Product Approval Trends	Review Action Closure Trends	Risk Exposure Trends	Risk Handling Trends	Technology Maturity Trends	Technical Measurement Trends	Systems Engineering Staffing & Skills Trends	Process Compliance Trends	Test Completeness Trends	Resource Volatility Trends	Defect/Error Trends	Algorithm/ Scenario Trends	System Affordability Trends	Architecture Trends
6.3 Project Processes																			
6.3.1 Project Planning Process																			
6.3.1.3.a Define the project																			
6.3.1.3.b Plan the project resources												x			x				
6.3.1.3.c Plan the project technical and quality management						x	x									x			
6.3.1.3.d Activate the project																			
6.3.2 Project Assessment and Control Process																			
6.3.2.3.a Assess the project						x	x					x	x		x	x			
6.3.2.3.b Control the project						x	x					x	x		x	x			
6.3.2.3.c Close the project																			
6.3.3 Decision Management Process																			
6.3.3.3.a Plan and define decisions										x								x	
6.3.3.3.b Analyze the decision information										x								x	
6.3.3.3.c Track the decision										x								x	
6.3.4 Risk Management Process																			
6.3.4.3.a Plan Risk Management																			
6.3.4.3.b Manage Risk Profile																			
6.3.4.3.c Analyze Risks								x											
6.3.4.3.d Treat Risks								x	x										
6.3.4.3.e Monitor Risks								x	x										
6.3.4.3.f Evaluate Risk Management Process								x	x										
6.3.5 Configuration Management Process																			
6.3.5.3.a Plan configuration management																			
6.3.5.3.b Perform configuration management		x																	
6.3.6 Information Management Process																			
6.3.6.3.a Plan information management																			
6.3.6.3.b Perform information management		x																	
6.4 Technical Processes																			
6.4.1 Stakeholder Requirements Definition Process																			
6.4.1.3.a Elicit Stakeholder Requirements	x																		
6.4.1.3.b Define Stakeholder Requirements	x																x	x	
6.4.1.3.c Analyze and Maintain Stakeholder Requirements	x	x		x							x						x	x	

Leading Indicator Affinity Table

Table 2 LEADING INDICATOR AFFINITY

	Requirements	System Definition Change Backlog	Interface	Requirements Validation	Requirements Verification	Work Product Approval	Review Action Closure	Risk Exposure	Risk Treatment	Technical Maturity	Technical Measurement	Systems Engineering Staffing & Skills	Process Compliance	Test Completeness	Facility and Equipment Availability	Defect and Error	Algorithm/ Scenario	System Affordability	Architecture	Schedule and Cost Pressure
Requirements (10)		X		X	X	X							X	X		X	X	X	X	
System Definition Change Backlog (3)	X		X			X														
Interface (9)		X		X	X	X			X	X				X		X			X	
Requirements Validation (4)	X		X		X					X										
Requirements Verification (9)	X		X	X		X				X			X	X		X	X			
Work Product Approval (5)	X	X	X		X							X								
Review Action Closure (3)										X	X			X						
Risk Exposure (6)									X		X			X	X			X		X
Risk Treatment (9)			X					X		X	X	X			X	X	X	X		
Technology Maturity (8)			X	X	X		X		X			X	X	X						
Technical Measurement (6)							X	X	X			X		X					X	
Systems Engineering Staffing & Skills (6)						X			X	X	X				X					X
Process Compliance (3)	X				X					X										
Test Completeness (11)	X		X		X		X	X		X	X					X	X		X	X
Facility and Equipment Availability (5)								X	X			X						X		X
Defect and Error (6)	X		X		X				X					X					X	
Algorithm/Scenario (5)	X				X				X					X					X	
System Affordability (5)	X							X	X						X					X
Architecture (6)	X		X								X			X		X	X			
Schedule and Cost Pressure (5)								X				X		X	X			X		

- Included in analysis of cost-effective measures – may support trade-off analysis of measures by understanding the related measures

NAVAIR Applied Leading Indicators (ALI) Methodology

- Systematically analyzes multiple data elements for a specific information need to determine mathematically valid relationships with significant correlation
  - These are then identified as Applied Leading Indicators
- Provides a structured approach for:
  - Validation of the LIs
  - Identifying most useful relationships
- Unanimous agreement to include this in the SELI guide
- NAVAIR (Greg Hein) to summarize the methodology for incorporation into the SELI Guide revision as an appendix
  - Summary will include links to any supplementary information and guidance

Interaction with SERC SE Effectiveness Measurement Project

- SE Leading Indicators Guide is pointed to from SERC SE Effectiveness Measurement (EM) project for quantitative measurement perspective
- SERC EM contribution:
  - Short-term:
    - Mapping of SE Effectiveness Measurement Framework to SE Leading Indicators (SELI)
      - 51 Criteria => Critical Success Factors => Questions => SELI
        - Critical Success Factors serve as Information Needs
        - Questions serve as Measurable Concepts
    - Mapping of 51 Criteria to SELI
    - Review to ensure consistency of concepts and terminology
  - Longer-term:
    - Work with OSD to get infrastructure in place to support data collection and analysis
      - Tie to SRCA DB (TBR)
      - May require government access and analysis

QUESTIONS?